Effect of Superman Evolutionary Scheme and Nudge Based Intervention on Screen Time and Cognitive Profile of Foundational Level Students

Synopsis

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1.0 Introduction

Early childhood years open doors of opportunity to shape the trajectories of a child's holistic development and build the foundation for their prosperous future. Children's early life experiences make a vital difference as their brains develop, providing foundations for learning and behavior throughout life (UNICEF, 2020). Technology has become an inevitable part of everyone's life worldwide. The last couple of decades have accelerated the use of screen time, which is a growing concern, especially among young children. Indians spent an average of 4.7 hours of screen time, as measured by mobile data and analytical firm App Annie (Times of India, 2021).

The time spent playing games, watching digital screens, and surfing social media sites is termed screen time(Kerai et al., 2022). An excess of everything is considered atrocious. Over the past decade, several studies have affirmed the adverse effect of excessive screen time on children's psychological and physiological areas (Lissak, 2018). The Academy of Pediatrics (AAP) recommended that children older than 2 years should not face screen time of more than 2 hours. Screen time has undoubtedly shown tremendous growth during the pandemic for all age groups of children. A report published in the Economic Times (2022), based on a newly released survey, states that children's screen time spiked by 52% between 2020 and 2022. Studies have suggested that increased screen time is linked with poor cognitive (Madigan, 2019) and executive functions (Lillard and Peterson, 2011). Screen time can benefit children up to certain limits, like using digital devices to study through educational apps. Prolonged use of screen time for young children is linked to negative health outcomes, behavior problems, emotional regulation problems, academic issues, and, most importantly, lower executive functioning (Radecki, 2015; Fang, 2019; Tamana et al., 2019; Del Prozo, 2019; Adelantado- Renau, 2019; Kostyrka- Allchorne, 2017). As screen time has increased, the regular engagement of children with nature has decreased. The benefits of natural environments could be gained through increased physical activity and social connections experienced in greenspaces like agroecology-cum-precision farming fields, parks, etc. (Hartig et al., 2014). One of the recent activities initiated in the Dayalbagh area of Agra is the Superman Evolutionary Scheme, which involves spending time in a natural setting

1.0.1 Superman Evolutionary Scheme of Dayalbagh

According to Encyclopedia Britannica (2016), the term "superman" was first significantly used by

Nietzsche, a German philosopher, in his work *"Thus Spoke Zarathustra"* in 1883. Later on, Bernard Shaw used the term 'Superman' in his famous play '*Man and Superman*' in 1903. Nietzsche believes that the concept of Superman represents the highest principle of humanity's development. The Greek philosopher Plato also spoke about the need for Superman in society. According to his ideology, Superman should be strong, active, brave, spirited, and power-intoxicated, be able to lead society and be devoted solely to humanity (Baig, 2022). Darwin states that Superman is the lightning that has come out of the dark cloud (Baig, 2022). As the term Superman has been glorified in Western countries, our nation also has its richness in Indian philosophy. Swami Vivekananda's ideology on Superman was to become the soul that could serve the weakest, the poorest, and the most ignorant. Dayalbagh's concept of Superman is a new one: unique, incomparable, and unparalleled (Satsangi Sahab, 2017). The term Superman here in Dayalbagh is neutral, i.e., not gender biased. This Superman is in the process of becoming a compassionate, humble, and universal being.

Superman was further defined by Satsangi Sahab in 2017 as a complete man with a balanced development of body, mind, and spirit.

"He will not come into existence in a day; he will evolve gradually as the human body evolves gradually according to the Darwinian principle. As is the case with the body, mind, and spirit, they will also evolve gradually, and the spirit and mind will become so pure that a Superman will come into existence" (Satsangi Sahab, 2017).

Dayalbagh launched a scheme called 'Sant Su(perman) Evolutionary Scheme' in January 2017, in which infants and children in the age group of three weeks to twelve years participate in several activities peculiar to better worldliness, which is the Dayalbagh way of life in agroecology-cum-precision farming fields. These children are now called superhumans. The children can come either in the early morning or evening, or both, with their parents or guardians every day. The scheme is in four phases as per the age range, i.e., 3 weeks to 3 years, above 3 years to five years, 5 years to 8 years, and 9 years to 12 years.

1.0.1.1 Activities of Superman's Evolutionary Scheme

The activities included in the Superman Evolutionary Scheme are as follows:

The "hole in the wall" experiment for computer literacy, where students learn basic computer skills

through incidental learning, is adopted in the Superman scheme. Another one is self-defense training along with physical training (PT), where children follow the commands in Sanskrit and learn martial arts kicks like sidekicks, front kicks, etc. with their peers under the supervision of SFG (Security Force Group). Under SFG, male and female volunteers ensure the safety of toddlers and elderly adults in agroecology-cum-precision farming fields. Children play different indoor and outdoor games in the open environment, like chess, board games, running and chasing each other and riding on swing sets. Doctors provide their voluntary services in the agroecology-cum-precision farming fields. A pediatrician examines children's weight and height and calculates their body mass index (BMI) at regular intervals to keep track of their physical development. In honor of auspicious festivals or national events like Lori, Basant, Independence Day, etc. children showcase their talents by preparing cultural activities like singing, dancing, etc. Children from 489+-1centers across the world are connected in virtual mode. They present a cultural program on rotation in the evening and morning sessions. This gives exposure to different cultures and languages to all the children involved. A new activity has been recently added to the scheme, i.e., learning Sanskrit, which means children learn to use Sanskrit in their conversation. Besides these activities, children also go to the park for an hour. The scheme is not confined to precise activities only, it is dynamic. Children are so enthusiastic to play in the fields that no sweltering heat, torrential rain, or shivering winter can thwart them. This scheme is set up to provide children with an opportunity to expand their imaginations and have fun with their peers in natural settings.

1.0.2 Nudge-Based Intervention

In educational psychology, it is often difficult to achieve the desired behavior (Ruggeri, 2019). Nudging theory is a flexible and modern approach frequently used in the behavioral sciences, behavioral economics, and social psychology that asserts that subtle and slight changes in people's environments can effectively bring about positive behavioral change and good decision-making (Wejjers, 2020). The concept of nudge theory was primarily introduced by the American academicians Richard Thaler (a 2017 Nobel Prize winner in Economics) and Cass Sunstein. The concept of nudge was popularized through their piece of work in the 2008 international best-selling book *Nudge: Improving Decisions about Health, Wealth, and Happiness* (Thaler and Sunstein, 2008). The roots of

nudge theory can be witnessed in philosophical and psychological concepts. From a philosophical and motivational standpoint, Abraham Maslow, the founder of the famous motivational theory Hierarchy of Needs, understood and articulated the ethos and principles of the Nudge Theory in the 1950s and 1960s (Business Balls, 2014). Primarily, nudges were introduced in the field of policy to help people make decisions; later, they were widely applied in other domains associated with human behavior.

Nudges in education have successfully achieved goals and behavior change among children (Damgaard and Nielsen, 2018). For example, by texting the parents three times a week with reminders to do a literary activity, Students were asked to create task-specific goals for a course, which encouraged them to take additional practice tests (York et al., 2019; Clarks et al., 2019). A teacher's weekly one-sentence report to parents on the student's performance significantly decreased student dropout (Kraft and Rogers, 2015).

A literature review on nudging found that only 4% of studies use nudges in educational research (Szaszi,2018). This is due to the unique qualities of the educational environment. For instance, initiatives to influence educational behavior frequently focus on long-term behavioral change (Dunlosky et al. 2013). A long-term impact is now one of nudging's biggest obstacles, (Marchiori et al., 2017). A nudge in education shouldn't conflict with fundamental principles like knowledge transfer, nor should it have detrimental side effects in other crucial areas. This responsibility is enhanced because nudges in most other areas target the adult population, but nudges in education target children (Weiders, 2021). If nudges were used in education, could they help with long-term behavioralmodification of children? How long the effect lasts after the nudge is taken away is a question of research. In the present study, nudge-based intervention will be used to address the problem of excessive screen time among young children.

1.0.2.1 Strategies for Nudge Based Intervention

Table 1. Strategies for Nudge Based Intervention

S.No.	Strategies	Rationale
1.	**Parental control apps**	There are built-in settings in Android as well as iOS software or apps that allow creation of content filters. It also allows blocking of specific websites, web searches, or even keywords (Xu et al., 2023).

2.	**Physical activity**	Regular physical exercise and physical activity not only restrict screen time among children but also help to enhance the cognitive domains of the children (Dahlgren, 2021).
3.	**Screen time monitoring**	Monitoring screen time, online diverse activities, and media content may promote a healthy environment among young learners (Canadian Pediatric Society, 2017).
4.	**Hiding all gaming apps**	Digital gaming and enhanced screen time can negatively affect the physical and mental development of learners (Chaudhary et al., 2022).
5.	**Display**	Reducing blue emitting light from the screen (Chang et al., 2014); Greyscale setting may reduce anxiety, sleep schedule, and motivation to use the phone (Holte, 2021; Myers, 2021).
6.	**Defaults and preset alarms and reminders**	Screen time defaults e.g., Do Not Disturb during certain hours, and setting alarms and reminders can merely help in reducing screen time among children

Overview of Strategies of nudge-based intervention

In the present study, the researcher will use nudge-based intervention strategies to help children at a foundational level to reduce their screen time and strengthen their cognitive profile. Setting default device configuration to limit screen time like Do Not Disturb and setting alarms and reminders after a certain time limit will work as a nudge for children. Display settings like turning on greyscale will reduce the emission of blue light which causes a delay in sleep while using a mobile phone will be one of the strategies for controlling screen time. Using Parental control apps will limit the usage of screen time among children and motivate them to do diverse activities. It will also help to keep track records of the children's activities. Children mostly get attracted to video games, online as well as offline. It will be requested that parents uninstall all gaming applications from their phones to restrict the screen time of children. Nowadays mobile phone company's software whether Android or iOS have the built-in feature of monitoring the screen time of users. So, through this strategy, the researcher will keep track of monitoring the screen time of children. It will show all the details of how much time is spent, and what application has more screen time. One of the nudge-based strategies used by the researcher will be physical activity. In this child will participate in extracurricular activities and sports competitions organized at school. It will not only limit their screen time but also enhance the cognitive domains of children.

1.0.3 Screen time

A recent study published in JAMA Pediatrics reported that the average amount of time spent on screens has increased to 52% globally (Ellis, 2022). Screen time is the amount of time spent on diverse activities performed online and offline using digital devices. Children are exposed to screen usage in the early years of life, increasing gradually (Qi, 2023). Children's screen time increased by more than 3 hours during the pandemic compared to pre-pandemic (Seguin et al., 2021).

1.0.4 Cognitive profile

The transition from infancy to adulthood is one of the key developmental phases, which can be especially difficult due to cognitive ability, learning contexts, and different personal experiences (Duncan, McClelland, &Adcock, 2017; Lo, Chen, & Lin, 2017). A cognitive profile is an individual's own set of strengths that they face across all life domains (Mandy et al., 2015). IQ tests remain fixed in school psychology training and practice. Researchers have long debated how these measures should be interpreted by children and adolescents, and later, this controversial aspect of the debate introduced the term cognitive profile analysis (McGill et al., 2018). Researchers have long debated the utility of cognitive measures in clinical practice (Fiorello et al., 2007; Watkins, 2000). Numerous cognitive profile analysis theories and procedures are described in test technical manuals and clinical guidebooks (Flanagan & Alfonso, 2017; Kaufman, Raiford, & Coalson, 2016; Grohman& Wright, 2016; Sattler, 2008).

When conducting a cognitive profile analysis of an individual, various domains of cognition are assessed to understand the individual’s cognitive abilities. There are some common broad domains included in assessing the cognitive profile of an individual. Such domains are intellectual abilities, memory and learning, executive function, attention and concentration, language and communication, visual-spatial skills, processing speed, social cognition, motor skills, and academic skills. These domains provide a framework for evaluating different aspects of cognitive functioning.

In the present study, the researcher will assess the two main domains of the cognitive profile, i.e., core executive function and cognitive abilities, of students enrolled in the Superman Evolutionary Scheme and students exposed to Nudge-based intervention.

1.0.4.1 Core Executive Functions

Executive functions (EFs) are a family of hierarchical cognitive processes needed when you have to concentrate or pay attention, juggle multiple tasks or set focus, and control your instincts. Executive functions are higher-order cognitive functions that allow a person to successfully implement independent and useful behaviors. It is a set of cognitive skills that are needed for managing behaviors. These skills are implemented in classroom behavior and learning and, more specifically, in the pursuit of goal-directed behavior, actions, and cognitions (Diamond, 2013). There are three core executive functions: inhibitory control (self-control), cognitive flexibility (also called set shifting or mental set shifting), and working memory (Diamond, 2012). Executive function begins to develop in infancy (Hughes et al., 2020) and does not stop until adulthood (Friedman et al., 2016). Research-based on executive functions and screen time has shown an inverse relationship (Barr et al., 2010; Lillard and Peterson, 2011; Nathanson et al., 2014; Cliff et al., 2018). Children aren't born with these skills, but they tend to build them.

1.0.4.1.1 Working Memory

Memory is the human tendency to store information; it is a process of encoding, retrieving, storing, and decoding information. Atkinson and Shiffrin's multi-store memory model and Baddeley and Hitch's working memory model are the most important memory models used in most of the research (Atkinson & Shifrin, 1971; Baddley & Hitch, 1974). The term *working memory* was perhaps first used in psychology (Miller et al., 1960). A bit later, the term working memory was used to describe a multi-component system in the human mind and brain that temporarily retains limited information while processing it (Baddeley & Hitch. 1974). Working memory is the ability to acquire and retain information while performing any task that will later be modified and rearranged. It has been reported that screen time has an inverse relationship with working memory (Christakis & Ramirez, 2012; Christakis et al., 2018).

Excessive screen time in childhood may impair the development of cognitive processes, including working memory (Lillard et al., 2015). Children aged 3.8 years showed negative consequences of screen time on their working memory (Danet et al., 2022). A scoping review by Neo phyton, Manwell, and Eikenboom on 44 articles has concluded that exposure to excessive screen time can

immoderately induce reductions in working memory and various cognitive functions among children and adolescents (Christakis, 2018).

1.0.4.1.2 Inhibitory Control

Inhibitory control is the ability to control one's thoughts, behaviors, and emotions to counteract the strong internal predisposition and instead do what is more needed. Inhibition and interference control contribute to the regulation of one's behavior, attention, thoughts, or emotions to respond to stimuli appropriately by overruling habitual or dominant responses. (Warsaw et al., 2021).

1.0.4.1.3 Cognitive Flexibility

Cognitive flexibility is the last core executive function, which builds based on the other two and comes much later in development (Davidson et al., 2006; Garon et al., 2008). Cognitive flexibility refers to the ability to switch between thinking about two or multiple concepts simultaneously (Magnusson &Brim, 2014).

1.0.4.2 Attention

Attention is one of the most fundamental tasks of the brain, one that is crucial for the performance of other cognitive tasks (Ocasio &Wohlgezogen, 2010). A meta-analysis concluded that television viewing or gaming among 4–17-year-old children was modestly associated with later ADHD symptoms (Nikelen et al., 2014). Children with ADHD, ADD, or even just difficulties with focus and attention can have resulting struggles with executive functioning skills. There are many executive function skills tied to attention and focus that interfere with success in the classroom, home, extracurricular activities, and community (Mupppala et al., 2023). These are abilities that develop through maturation and developmental progression (For some, these skills develop more easily than others. For the child who struggles with attention, these executive functioning abilities may be lacking, causing difficulties in all areas of life.

1.1 Emergence of the problem

Children use screens to study, play, and kill their leisure time. Despite the convenience that screens provide, it has become a grave concern across the world (Chen, 2018; Madigan, 2019). One of the reasons for increased screen time can be the ease of accessibility and advancements in technology. Technology has virtually conquered the lives of children with the invention of easily portable gadgets

and instantly available internet access. Prolonged use of TV, video games, and scrolling through social media acts like a digital drug for our brain. It releases dopamine in the brain, which can negatively affect inhibitory control (Lorenz, 2018). Studies have reported that screen time affects the frontal cortex of the brain, which is similar to the effect of cocaine (Meade, 2020). A study conducted on British toddlers concludes that increasing screen time from 2 to 3 years of age results in worsening executive function (McCarthy et al., 2020). These young children are particularly at risk of delayed language development, emotional problems, defiant behavior, and poor academic performance through preschool ages and throughout childhood (Tomopoulos, 2010; Madigan, 2020; Chonchaiya, 2015; McArthur, 2021, as cited in Sugiyama et al., 2023).

With technological advancement, children spend prolonged time using screens, and the COVID-19 pandemic later aggravated the issue. It came with restrictions like widespread school closures, quarantine, and the proliferation of online learning. As a result, the usage of digital devices and excessive screen time increased manifold across the world (Pandya, 2021). Several health bodies, like the WHO, and the American Academy of Pediatrics, have given guidelines for the exposure of young children to screen time; however, adherence to these guidelines is low (McArthur, 2022). This issue is widely researched in terms of its effects on users.

Given the increased reported use of screens by some people and, on the other hand, the fact that there is a group that is involved in the multifarious activities of the Superman Scheme to meaningfully engage young learners, leaving little time to spend with the gadgets, it becomes interesting to know if it has a mitigating effect on screen time and if it affects the cognitive abilities of the participants.

Researchers have found that screen time has adverse effects on children in different psychological areas. In previous research, it has been said that nudge-based interventions can help reduce screen time among adults (Olson, 2022). In the present study, researchers are keen to examine if nudge-based interventions will help reduce screen time in children. On the other hand, the Superman evolutionary scheme has various activities in it. Is the Superman evolutionary scheme itself a mitigating factor for screen time for children, or do participants require nudges to control screen time? And simultaneously, how is it affecting the cognitive profile of children? Can providing nudges to children improve their screen usage and cognitive profile?

The present study is important to find answers to the following research problems:

Q1. What will be the effect of the Superman Evolutionary Scheme on screen time and the cognitive profile of foundational-level students?

Q2. What will be the effect of the nudge-based intervention on screen time and the cognitive profile of foundational students?

Q3.How do the Superman Evolutionary Scheme and Nudge-based Intervention affect the screen time and cognitive profile of foundational level students?

1.2 Justification of the problem

Several studies have been conducted to examine the negative effects of screen time on ADHD children in physiological and psychological areas, including neurodevelopment, neurodegeneration, mental health, learning, and memory (Cassandra 2019; Lissak, 2018; Eliana & Manwell, Laurie &Eikelboom, Roelof, 2021). Excessive screen use becomes problematic when our devices start controlling us instead of us controlling the devices (Sussman, 2021). Several Indian and global organizations have given guidelines and recommendations for on-screen time usage among children of all age ranges.

The American Academy of Pediatrics (2020) has recommended screen time for up to 18-month-old children, i.e., for video chatting with family, 1 hour per week for children in the age range of 2 to 5 years, and for children aged 6 and above, encourage healthy habits and limit the use of screen time. The World Health Organization (WHO, 2019) recommends that children up to one year old should not spend any time on digital screens, and for 2 to 5 years, less than 1 hour per day. The Canadian Society for Exercise Physiology issued guidelines on recreational screen time, recommending no screen time longer than 2 hours for young children, no screen time for preschoolers ranging in age from 3–4 years, and no screen time for young toddlers and infants less than 2 years (Guerrero, 2019).

In August 2020, the Indian Academy of Pediatrics (IAP) constituted a task force to formulate guidelines and recommendations on screen time and the digital wellness of children (Gupta et al., 2021). Nine sub committees were constituted to give a detailed narrative review of the evidence. After numerous rounds of changes, the final document was approved by the executive board of IAP (Gupta et al., 2021). Indian studies show similar trends in screen time among children as compared to

Western literature, with initial exposure to screen media as early as 2 months of age (Gupta et al., 2021). Ninety-six percent of children are exposed to Smartphone by 18 months of age, compared to television viewing at 89% (Meena et al., 2020). Four out of five preschool children reported using digital devices (Shah et al., 2019). A systematic review of Indian studies depicted an increment in Smartphone addiction among adolescents and children ranging from 39% to 44% (Davey, 2014). The Indian Psychiatric Association (2021) has suggested that there should be zero hours of screen time for young children (>2 years), and between 2 and 5 years, screen use should be for specific purposes like educational apps with a limit of 30 minutes or less. PRAGATYA (plan, review, arrange, guide, yak (talk), assign, track, and appreciate): the digital education guidelines were issued by the Ministry of Information and Broadcasting in association with the National Council for Education, Research, and Training (NCERT). Pre-primary children's screen time should not be more than 30 minutes, while children in 1–8-class online sessions should have 2 sessions (30–45 minutes) each (Gupta et al., 2021).

Early exposure to adult-directed media has shown a negative association with executive functioning and cognitive development (Barr et al., 2010). Background television viewing has disrupted sustained toy play in preschoolers and has also shown a negative impact on parent-child interaction (Schmidt, 2008). A systematic review concluded that children with excessive screen time have delayed learning problems, language problems, and reading problems (Li et al., 2020). Children older than six years have shown changes in their behaviors to become aggressive and antisocial due to exposure to violent content, and these changes can be long-lasting and shape the child's personality. It reported increased hostility, physical fights, and poorer school performance (Gentile et al., 2004).

Interventions have been carried out in schools, homes, communities, and clinics, ranging from imparting knowledge to attempting behavioral modification and environmental interventions. The majority of the interventions were behavioral, using behavioral modification. The most effective interventions were those that specifically targeted and established goals for reducing TV viewing or screen media use, used electronic monitoring devices, provided clinic-based counseling, had a high level of parent involvement, and had a contingent feedback system (Schmidt et al., 2012; Maniccia et al., 2011).

A study conducted on children found excessive screen use in infancy results in poorer executive functioning once children reach 9 years of age (Law, 2023). To reduce children's screen time, a case study was conducted in Turkey aiming to direct children to do alternative activities within a week by applying the project of “screen-free week” to voluntary families (Kara, 2018). A study conducted on university students shows the level of cognitive flexibility increases as screen time addiction decreases (Saar, 2021). For the past two decades, screen time research has been more focused on what interventions and strategies should be given to children to reduce their screen time and improve their cognitive development domains. A systematic review and meta-analysis were conducted to identify effective intervention strategies to reduce children's screen time and have concluded that to optimize effective interventions and maximize resources, an understanding of “active ingredients” in behavioral interventions is needed to reduce screen time among children (Jones, 2021). The effects of behavioral interventions that included goal setting, goal reviewing, and self-monitoring were greater. A systematic scoping review concluded that providing green time to children of several age groups could suffer the consequences of screen time (Oswald, 2020).

Existing interventions to reduce screen time among children lack behavioral modifications, behavior change techniques, and more connection to nature (Jones et al., 2021; Larson et al., 2018). An initiative of theDayalbagh Superman Evolutionary Scheme seems to connect children to nature. It may be possible that the participants of the Superman Evolutionary Scheme, who are spending most of their time in agroecology-cum-precision farming fields, attending diverse activities, and working in a natural setting, get less time to spend on the screen. On the other hand, a narrative systematic review identified behavior change techniques (BCT) as an effective intervention for reducing screen time in 0-5-year-old children (Lewis, 2021). Nudges are subtle, non-coercive intervention strategies designed to influence people’s behavior positively. Nudge-based intervention has been implemented to reduce Smartphone addiction in adults (Olson, 2020). In the present study, the researcher will examine if nudges could work as a mitigating factor for screen time and enhance their cognitive abilities. It can be found in the Superman Evolutionary Scheme activities could help in reducing screen time, if the nudges provided to children can help them perform better, or if both can be used simultaneously to reduce screen time and enhance the cognitive profile of the foundational level

students.

1.3 Statement of the problem

Effect of Superman Evolutionary Scheme and Nudge-Based Intervention on Screen Time and Cognitive Profile of Foundational Level Students

1.4 Operational Definition of Constructs

1.4.1 Superman Evolutionary Scheme

The Superman Evolutionary Scheme is the scheme started in 2017 by the Most Revered Professor, Prem Saran Satsangi Sahab to promote the holistic development of children in the age range of 3 weeks to 12 years.

1.4.2 Nudge-based intervention

Nudge-based intervention is defined as “any choice architecture that alters people’s behavior predictably without forbidding any option or significantly changing their incentives” (Thaler and Sustein, 2008, p. 6).

In the present study, nudge-based intervention includes strategies like screen monitoring, hiding all gaming apps, and activating parental control apps for reducing screen time among foundational level children and enhance their cognitive profile.

1.4.3 Screen time

According to the Cambridge Dictionary, “Screen time is the amount of time someone spends looking at an electronic device with a screen, such as a television, mobile phone, or tablet.”.

In the present study, In the present study, screen time refers to the average time children spend interacting withnon-educational media content online and offline using digital devices as reported by the parents.

1.4.4 Cognitive profile

The cognitive profile refers to specific procedures, measures, and criteria used to assess and describe an individual’s cognitive abilities, strengths, and weaknesses across different cognitive domains. It involves converting abstract constructs like intelligence, memory, attention, executive function, etc. into observable and measurable variables.

In the present study, cognitive profile refers to a comprehensive description of an individual’s

cognitive abilities in two main domains i.e., core executive functions and attention.

1.4.5 Executive functions

Executive functions refer to the skills that help us to plan, prioritize, focus, work towards goals, self-regulate behaviors, and emotions, adapt to new and unexpected situations, and ultimately engage in abstract thinking and planning.

In the present study, "executive function refers to the collection of cognitive skills (working memory, cognitive flexibility, inhibitory control) that give rise to goal-directed behaviors" (Buss and Lowery, 2020).

1.4.6 Working memory

Working memory is a small chunk of information that can be stored in the mind and used in the execution of cognitive tasks. It has often been associated with intelligence, information processing, executive function, comprehension, problem-solving, and learning in people ranging from infancy to adulthood (Cowan, 2014).

WM is the ability to acquire and retain informational knowledge throughout time while executing a specific task, which would then be retrieved, modified, and rearranged (Baddeley & Hitch, 1994).

1.4.7 Cognitive flexibility

Cognitive flexibility is the human knack for swapping between thinking about two or multiple events as per given circumstances. Cognitive flexibility enables an individual to work efficiently to disengage from a previous task, reconfigure a new response set, and implement this new response set for the task at hand (Dajani and Uddin, 2015).

In the present study, cognitive flexibility means the readiness with which one can selectively switch between mental processes to generate appropriate behavioral responses.

1.4.8 Inhibitory control

Inhibitory control is an umbrella term used to describe the voluntary control, or inhibition, of goal irrelevant stimuli, cognitions, and behavioral responses (Diamond, 2013).

In the present study, Inhibitory control refers to the ability to inhibit responses to irrelevant stimuli while pursuing a cognitively represented goal (Carlson & Mosses, 2001).

1.4.9 Attention

Attention refers to the cognitive process of focusing and concentrating on a specific task, activity, or stimulus. It involves the ability to selectively filter out distractions and maintain a sustained level of concentration. Attention is crucial for various cognitive tasks, such as learning, problem-solving, and information processing.

In the present study, attention is an ability that requires an individual to focus on a target stimulus while simultaneously filtering out irrelevant stimuli (McDermott et al., 2007).

1.5 Objectives of the study:

1. To study the effect of the Superman Evolutionary Scheme on the screen time of foundational level students.

2. To study the effect of nudge-based interventions on screen time of foundationallevel students.

3. To study the effect of the Superman Evolutionary Scheme on the cognitive profile of foundational level students.

4. To study the effect of the nudge-based intervention on the cognitive profile of foundational level students.

5.To study the comparative effect of the Superman evolutionary scheme and nudgebased intervention on the screen time of foundational level students.

6. To study the comparative effect of the Superman evolutionary scheme and nudge-based intervention on the cognitive profile of foundational level students.

1.6 Hypothesis of the Study

H01: There will be no significant effect of the Superman Evolutionary Scheme on the screen time of foundational level students.

H02: There will be no significant effect of nudge-based intervention on the screen time of foundational level students.

H03: There will be no significant effect of the Superman Evolutionary Scheme on the cognitive profile of foundational level students.

H04: There will be no significant effect of nudge-based intervention on the cognitive profile of foundational level students.

H05: There will be no significant difference in the effect of the Superman Evolutionary Scheme and

nudge-based intervention on the screen time of foundational level students.

H06: There will be no significant difference in the effect of the Superman Evolutionary Scheme and nudge-based intervention on the cognitive profile of foundational level students.

1.7 Variables of the Study

The two types of variables present in the study are as follows:

Independent variables: Superman Evolutionary Scheme and Nudge-based Intervention

Dependent variables: Screen time and Cognitive Profile

1.8 Delimitation of the study

1. The study will be limited to Agra City only.

2. The study will be limited to the age range of 6–8 years only.

1.9 Methodology of the Study

The present research will aim to study the effect of the Superman Evolutionary Scheme and nudge-based intervention on screen time and the cognitive profile of foundational level students. The researcher will use a quasi-experimental research design. It is used when the independent variable is manipulated, participants are not randomly assigned to conditions (Cook & Campbell, 1979).

1.10 Research Design of the Study

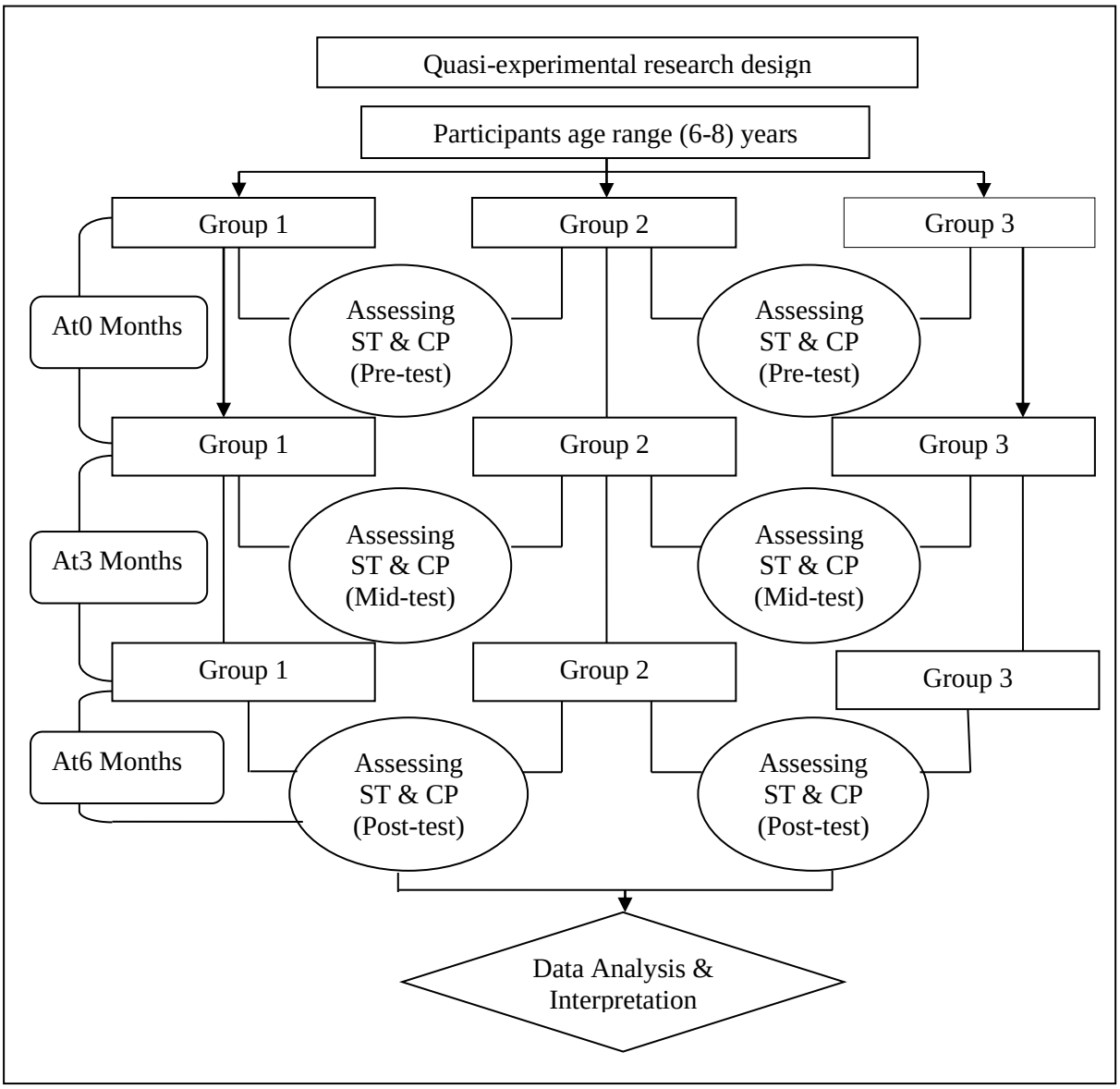

Figure 1: A flow chart of quasi experimental research design

Overview of the Design

In the present study, the researcher will use a quasi-experimental research design to fulfill the study's objectives. The participants who are enrolled in the Superman Evolutionary Scheme will constitute Group 1, the participants who are not enrolled in the Superman Evolutionary Scheme and will be exposed to another intervention, i.e., a nudge-based intervention, will form Group 2, and Group 3 will be the control group. A pre-test on screen time will be administered to all three groups, and a cognitive profile will be developed through assessments.

The participants in Group 1 will be exposed to the activities of the Superman Evolutionary Scheme, and the participants in Group 2 will be exposed to nudge-based intervention for six months. The participants in Group 3 will get no treatment and will be treated as a control group. A mid-test will be administered after three months of intervention, and a post-test will be administered at the end of the intervention, i.e., six months, to all three groups.

In the treatment phase, there will be two EGs. In EG1 the participants who are actively enrolled in the Superman evolutionary scheme in the age range of 6-8 years will be selected. The activities that are conducted in the Superman Evolutionary Scheme are mentioned in section 1.0.1.1. Under the head 'Activities of Superman Evolutionary Scheme'. Simultaneously, in EG2 participants who will be exposed to Nudge based intervention will get intervention in the form of nudges that are mentioned in section 1.0.2.1 under the head 'Strategies for Nudge Based Intervention'.

1.11 Sample design of the study

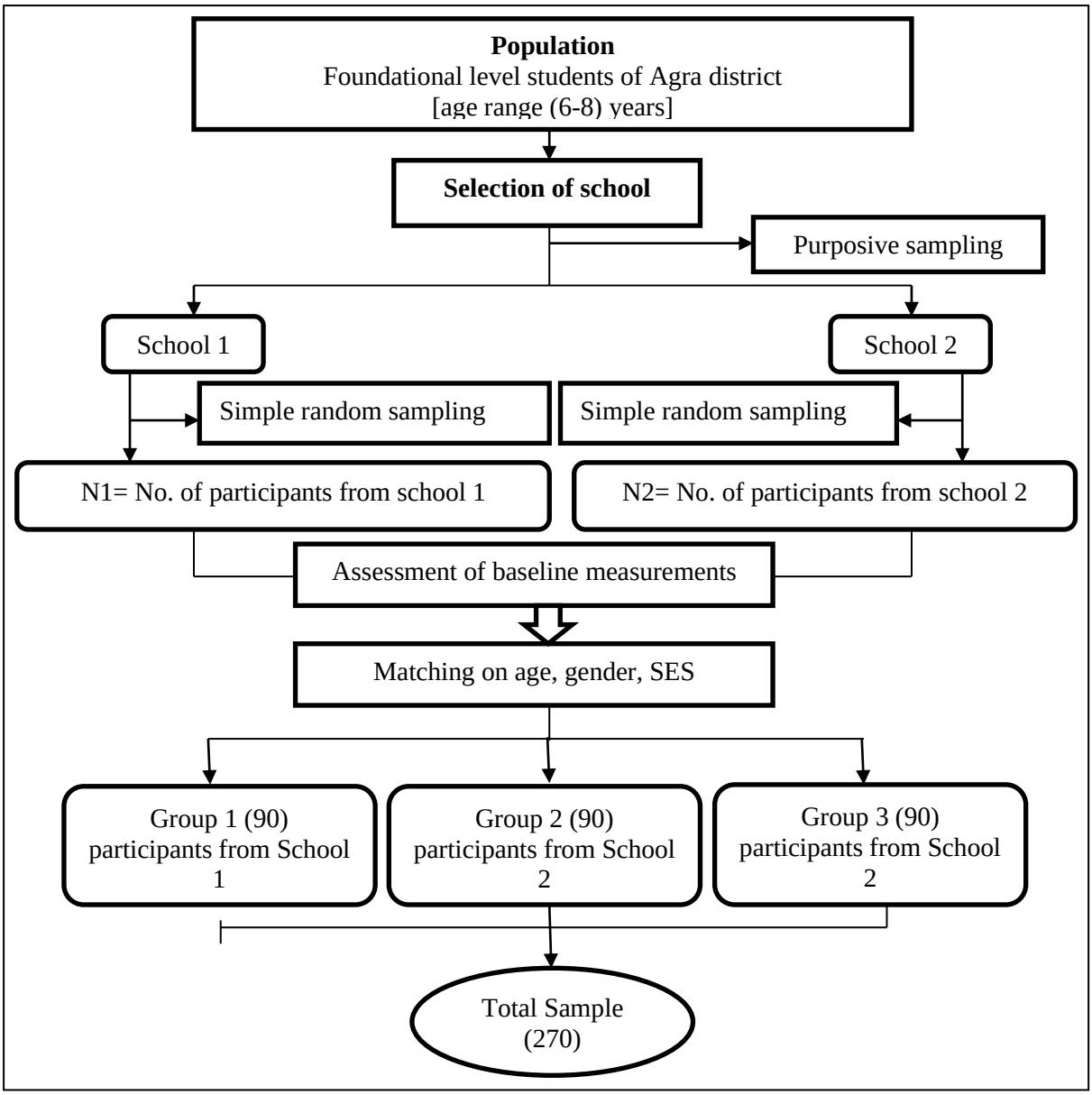
Population
Foundational level students of Agra district
[age range (6-8) years]
Selection of school
Purposive sampling
School 1
School 2
Simple random sampling
Simple random sampling
N1= No. of participants from school 1
N2= No. of participants from school 2
Assessment of baseline measurements
Matching on age, gender, SES
Group 1 (90) participants from School 1
Group 2 (90) participants from School 2
Group 3 (90) participants from School 2
Total Sample (270)

Figure 2: A flowchart of sample design

Overview of the sampling procedure

In the present study, foundational level students will constitute the population of the study in the age range of 6-8 years. Participants of Group 1 (Superman Evolutionary Scheme) will be selected from School 1, out of the total number of students enrolled in the Superman Evolutionary Scheme in the age range of 6-8 years. 90 students will be selected using simple random sampling. Participants in Group 2 (Nudge based intervention) will be selected from School 2 and 90 students will be selected by purposive sampling. As a control group in Group 3, the participants selected from School 2 will

get no treatment, and 90 students will be selected using purposive sampling. There will be 270 sample units in the present research.

Two schools will be selected for three groups because in one school the number of participants in the age range of 6-8 years is approximately 110 (i.e., 36 participants in each group). When we compare the three groups, the sample size will be small, which is not enough to get more generalized results. In the present study, the total sample size will be 270, which cannot be attained from one school, hence two schools will be selected. Also, selecting two schools can diversify the environments in which the intervention groups operate and it eliminates risk bias associated with a single school.

Strategies to control Extraneous variable

Firstly, two schools will be selected by purposive sampling. Participants in the age range of 6-8 years will be selected for the EG1 'Superman evolutionary scheme' through purposive sampling and for the EG2 'Nudge-based intervention' and control group by random sampling. A total of 270 sample units will be collected. The participants will be matched based on age in an equal ratio, to diminish biases in the research. If the required number of participants based on age is not approximate to the selected sample size, then more schools will be selected.

1.12 Procedure of the Study:

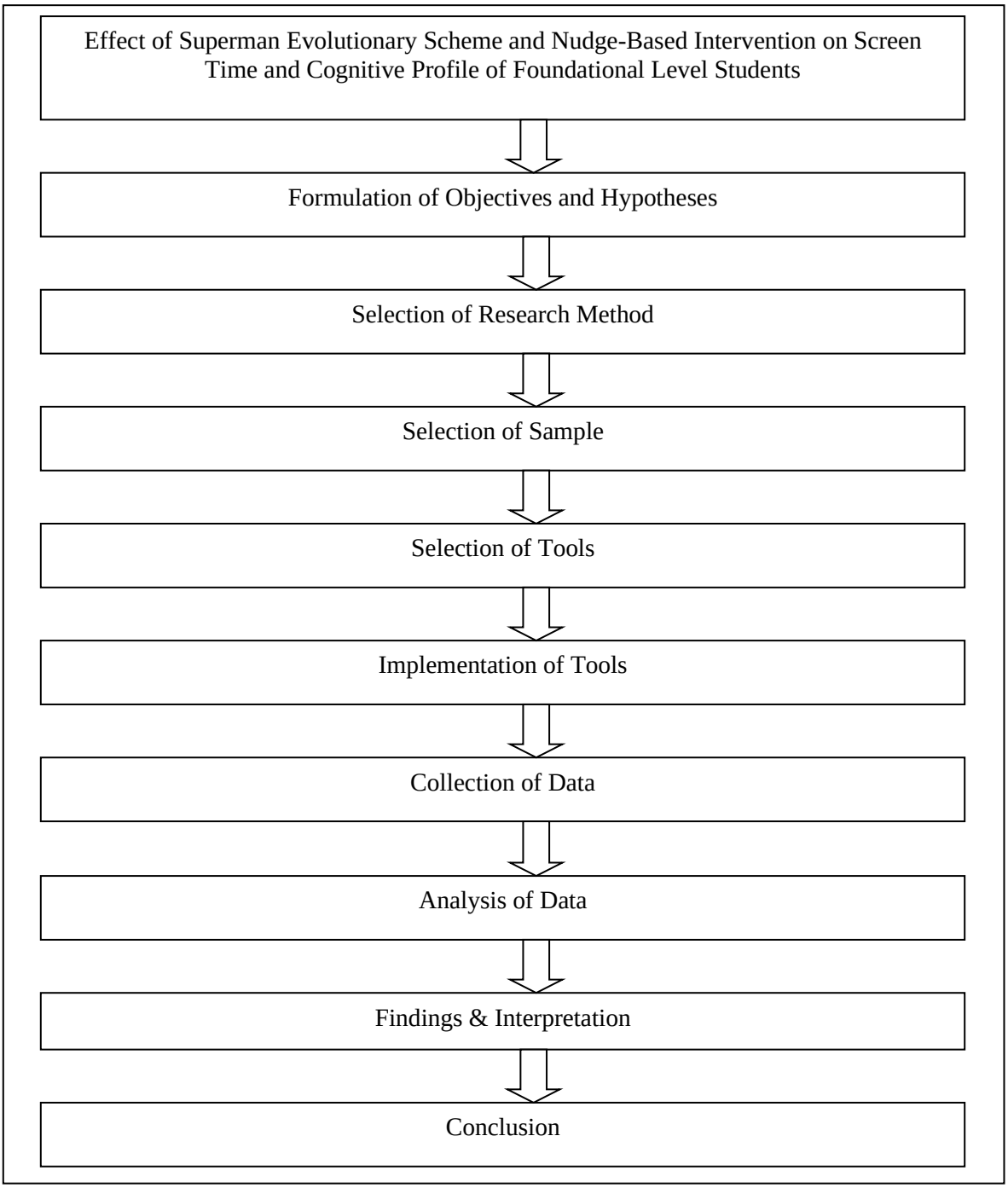
Effect of Superman Evolutionary Scheme and Nudge-Based Intervention on Screen Time and Cognitive Profile of Foundational Level Students
Formulation of Objectives and Hypotheses
Selection of Research Method
Selection of Sample
Selection of Tools
Implementation of Tools
Collection of Data
Analysis of Data
Findings & Interpretation
Conclusion

Figure 3: A flowchart of procedure of study

1.13 Research measures/tools

1.13.1 Screen time

In the present study, to assess the screen time of foundational-level students, the researcher will use the SCREENS-Q tool to assess children's screen media habits, the screen media environment, and potential correlates (Klakk, 2020). It covers six domains: screen media environment, child screen

media use, the context of screen media use, early exposure, parental perception of child media use, and parental media use. It comprises 19 questions and 92 test items—test-retest reliability with an ICC ranging from 0.67 to 0.90. For relevant nominal and ordinal data, kappa values are all above 0.50, with more than 80% of the values above 0.61 indicating good test-retest reliability.

1.13.2 Cognitive profile

For analyzing the cognitive profile of foundational-level students, the researcher will assess the two main domains: core executive function and attention.

Core executive functions

Working memory (WM)

To assess the WM, the Digit Span Test from the WISC-V subtests, which is an individual test, will be used (Wechsler, 2014).

Inhibitory control (IC)

To assess IC a tool regarded as the "gold standard" test of inhibition response is the go/no-go task (Georgiou and Essau, 2011). In this task, "GO" stimuli call for an instinctive and prepotent reaction from the user. The no-go stimulus requires inhibition of response.

Cognitive flexibility (CF)

To assess the CF and set-shifting, The Tower of Hanoi test, which is an individual test, will be used (Goal and Grafman, 1995).

Attention

To assess attention, the Eriksen Flanker task will be used (Flanker, 1974).

1.14 Statistical techniques

For the present study, both descriptive and inferential statistics will be applied to analyze and collect the data for findings and conclusions.

1.14.1 Descriptive statistics

Mean: The mean is often calculated because it provides the average value of datasets. It allows the researcher to summarize and analyze the data, make comparisons between groups, and draw conclusions about the overall trends and characteristics of the data.

Standard deviation: It will be used as a measure of variability or dispersion between datasets. It will

help to analyze the distribution of data, compare the groups, assess the reliability of measurements, and make inferences about the population based on a sample.

Skewness and kurtosis: These will be calculated to analyze the shape and distribution of datasets. Scenes measures the asymmetry of data distribution, whereas kurtosis measures the peaked Nessor flatness of data distribution. It will help to gain insights into the shape, symmetry, and outliers in the data, which can help in further analysis and interpretation of the data.

Graphical representation: Graphical representation of statistical data will be used to simplify complex data, support data interpretation, facilitate data comparison, and enhance data exploration.

1.14.2 Inferential statistics

ANOVA: To compare the effectiveness of two independent groups of the present study (Superman Evolutionary Scheme and Nudge Based Intervention) ANOVA will be used. The results of ANOVA (F-ratio) allow the analysis of multiple groups of data to determine variability between samples and within samples. In the present study, One-way ANOVA will be used to compare the means of two or more independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different. A one-way ANOVA evaluates the impact of a sole factor on a sole response variable. It determines whether all the samples are the same.

1.15 Significance of the study

The effect of the Superman Evolutionary Scheme and nudge-based interventions on screen time and the cognitive profile in research lies in their potential to address the growing concern surrounding excessive screen use and its impact on the cognitive development of foundational-level students. It will contribute to evidence-based practices that can be implemented in educational settings to mitigate the negative effects of screen time and support students' growth and cognitive development. Screen media has a wide range of cognitive consequences, both beneficial and detrimental. A long-lasting relationship was discovered between early screen media exposure and cognitive abilities by the Quebec Longitudinal Study of Child Development cohort study, with each hour more of TV exposure at the age of two resulting in a 7% unit decrease in in-class participation and a 6% unit decrease in math proficiency in the fourth grade (Pagnani et al., 2010). According to a Spanish study, increasing screen time was linked to worse academic performance. There was also a negative

association between the use of screen media and academic attainment. Similar findings were made by research done in the US, which discovered a strong correlation between increased media multitasking and worse marks on exams that gauge scholastic achievement in English and mathematics (Piero-LeVert et al., 2014). The outcomes of the present research will also have implications for future research and exploration.

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